WHAT IS CLAIMED IS:

1. Within a method of making an optical interference filter having thin layers of alternatingly high and low indices of refraction, a method of determining layer thicknesses, said method comprising the steps of:

(a) providing sample spectra and measurements of a predetermined characteristic associated with respective said sample spectra;

(b) selecting an initial number of said layers;

(c) selecting a thickness for each layer of said number of layers;

(d) determining a transmission spectrum of an optical filter having said number of layers and said selected thickness of each said layer;

(e) defining a first regression formula that relates an interaction of light with said transmission spectrum to a regression value;

(f) applying each said sample spectrum to said regression formula, thereby determining said regression value for each said sample spectrum;

(g) defining a comparison relationship between said regression values and said measurements; and

(h) optimizing said comparison relationship for said regression values, wherein thickness of each said layer is an optimization variable.

2. The method as in claim 1, wherein said regression formula includes the difference between said light transmitted by said transmission spectrum and said light reflected by said transmission spectrum.

3. The method as in claim 2, wherein said regression formula is defined as $Y = a_o + G(2T-1) \cdot S$, wherein Y is said regression value, a_o is an offset value, G is a gain value, T is said transmission spectrum, and S is the spectrum of said light, and wherein said offset value and said gain value are optimization variables in said optimizing step.

4. The method as in claim 1, wherein said comparison relationship includes an average of the differences between said measurement and said regression value for each said sample spectrum.

5. The method as in claim 4, wherein said comparison relationship includes a root mean square of said differences.

6. The method as in claim 1, wherein said optimizing step includes a quasi-Newton optimization.

7. The method as in claim 1, including

defining a tolerance level for said comparison relationship,

comparing said comparison relationship optimized at step (h) with said tolerance level, and

where said optimized comparison relationship is beyond said tolerance level, repeatedly increasing said initial number of layers and executing steps (c) - (h) until said optimized comparison relationship falls within said tolerance.

8. The method as in claim 1, wherein said optimizing step includes eliminating any said layer for which said thickness falls below a predetermined level during optimization.

9. The method as in claim 8, including

selecting a plurality of sets of initial conditions at steps (b) and (c), wherein each said set includes a selection of a number of layers and respective layer thicknesses,

executing steps (d) - (h) for each said set, and

selecting a group of layer thicknesses associated with said comparison relationship optimized at step (h) for one of said sets.

10. The method as in claim 1, including

determining a second regression formula that relates said sample spectra to said measurements,

defining a comparison relationship between said first regression formula and said second regression formula,

optimizing said last-mentioned comparison relationship for said regression formula, wherein thickness of each said layer is an optimization variable,

replacing said thicknesses selected at step (c) with thicknesses optimized in said last-mentioned optimizing step and re-defining said first regression formula based on thicknesses associated with said comparison relationship optimized at said last-mentioned optimizing step, and

executing steps (f) - (h) based on said replaced thicknesses and said re-defined first regression formula.

11. The method as in claim 1, including

(i) forming an optical filter segment comprising a first layer of said optical filter, based on a thickness for said first layer determined at step (h),

(j) determining an actual thickness of said first layer formed at step (i),

(k) where said actual thickness is less than a desired thickness of said first layer, adding a thickness to said first layer based on the difference between said actual thickness and said desired thickness.

12. The method as in claim 1, including

(i) forming an optical filter segment comprising a first layer of said optical filter, based on a thickness for said first layer determined at step (h),

(j) measuring a transmission spectrum of said filter segment,

(k) determining an actual thickness of said first layer based on said transmission spectrum determined at step (j),

(l) comparing said actual thickness to a desired thickness of said first layer,

(m) where said actual thickness is less than said desired thickness, adding a thickness to said first layer based on the difference between said actual thickness and said desired thickness.

13. The method as in claim 12, wherein said desired thickness is said thickness for said first layer determined at step (h).

14. The method as in claim 13, including, following step (m), comparing said difference to a predetermined threshold and repeatedly executing steps (j) - (m) until said difference falls below said threshold.

15. The method as in claim 13, including, following step (m), the step (n) repeating steps (b) - (h), including

selecting a thickness of said first layer resulting from step (m) as said thickness for said first layer at the repeated step (c), and

excluding thickness of said first layer as an optimization variable at the repeated step (h).

16. The method as in claim 15, including, following step (o), repeating steps (i) - (n) for successive layers of said optical filter, wherein each repeated step (i) includes forming each said successive layer on the previous said layer.

17. The method as in claim 13, wherein step (i) includes forming said first layer to a predetermined target thickness based on said thickness determined at step (h), and wherein step (k) includes

determining a target transmission spectrum of said optical filter segment, said target spectrum being a transmission spectrum that would be expected if said first layer were of said target thickness,

defining a comparison relationship between said transmission spectrum measured at step (j) and said target transmission spectrum, and

optimizing said last-mentioned comparison relationship for said target spectrum, wherein thickness of said first layer is an optimization variable.

18. The method as in claim 11, including, following step (k), the step (l) repeating steps (b) - (h), including

selecting a thickness of said first layer resulting from step (k) as said thickness for said first layer at the repeated step (c), and

excluding thickness of said first layer as an optimization variable at the repeated step (h).

19. The method as in claim 18, including, following step (l), repeating steps (i) - (l) for successive layers of said optical filter, wherein each repeated step (i) includes forming each said successive layer on the previous said layer.

20. Within a method of making an optical interference filter having thin layers of alternatingly high and low indices of refraction disposed on a substrate, a method of determining layer thicknesses, said method comprising the steps of:

(a) providing sample spectra and measurements of a predetermined characteristic associated with respective said sample spectra;

(b) selecting a substrate;

(c) selecting an initial number of said layers;

(d) selecting a material with which to make each layer of said number of layers;

(e) selecting a thickness for each layer of said number of layers;

(f) determining a transmission spectrum of an optical transmission filter having said substrate and having said number of layers, wherein each said layer is made of said material selected for said layer at step (d) and has said thickness selected for said layer at step (e);

(g) defining a first regression formula that relates an interaction of light with said transmission spectrum determined at step (f) to a regression value;

(h) applying each said sample spectrum to said first regression formula, thereby determining said regression value for each said sample spectrum;

(i) defining a comparison relationship between said regression values and said measurements, wherein said comparison relationship defines a comparison value; and

(j) optimizing said comparison relationship for said regression values to a minimum said comparison value, wherein thickness of each said layer is an optimization variable.

21. The method as in claim 20, including

selecting a plurality of sets of initial conditions at steps (b), (c) and (d), wherein each said set includes a selection of a substrate, an initial number of said layers and respective thicknesses, and a material with which to make each said layer,

executing steps (e) - (j) for each said set, and

selecting a group of layer thicknesses associated with said comparison relationship optimized at step (j) for one of said sets,

wherein said optimizing step includes eliminating any said layer for which said thickness falls below a predetermined level during optimization.

22. The method as in claim 20, including

determining a second regression formula that relates said sample spectra to said measurements,

defining a comparison relationship between said first regression formula and said second regression formula,

optimizing said last-mentioned comparison relationship for said first regression formula, wherein thickness of each said layer is an optimization variable,

replacing said thicknesses selected at step (e) with thicknesses optimized in said last-mentioned optimizing step and re-defining said first regression formula based on thicknesses associated with said comparison relationship optimized at said last-mentioned optimizing step, and

executing steps (h) - (j) based on said replaced thicknesses and said re-defined first regression formula.

23. The method as in claim 20, including

(k) forming an optical filter segment comprising a first layer of said optical filter, based on a thickness for said first layer determined at step (j),

(l) measuring a transmission spectrum of said filter segment,

(m) determining an actual thickness of said first layer based on said transmission spectrum determined at set (l),

(n) comparing said actual thickness to a desired thickness of said first layer, said desired thickness being said thickness for said first layer determined at step (j),

(o) where said actual thickness is less than said desired thickness, adding a thickness to said first layer based on the difference between said actual thickness and said desired thickness.

24. Within a method of making an optical interference filter having thin layers of alternatingly high and low indices of refraction disposed on a substrate, a method of determining layer thicknesses, said method comprising the steps of:

(a) providing sample spectra and measurements of a predetermined characteristic associated with respective said sample spectra;

(b) selecting a substrate;

(c) selecting an initial number of said layers;

(d) selecting a material with which to make each layer of said number of layers;

(e) selecting a thickness for each layer of said number of layers;

(f) determining a transmission spectrum of an optical transmission filter having said substrate and having said number

of layers, wherein each said layer is made of said material selected for said layer at step (d) and has said thickness selected for said layer at step (e);

(g) defining a regression formula that relates an interaction of light with said transmission spectrum determined at step (f) to a regression value;

(h) applying each said sample spectrum to said regression formula, thereby determining said regression value for each said sample spectrum;

(i) defining a comparison relationship between said regression values and said measurements, wherein said comparison relationship defines a comparison value;

(j) optimizing said comparison relationship for said regression values to a minimum said comparison value, wherein thickness of each said layer is an optimization variable;

(k) forming an optical filter segment comprising a first layer of said optical filter, based on a thickness for said first layer determined at step (j),

(l) measuring a transmission spectrum of said filter segment;

(m) determining an actual thickness of said first layer based on said transmission spectrum determined at step (l);

(n) comparing said actual thickness to a desired thickness of said first layer, said desired thickness being said thickness for said first layer determined at step (j);

(o) where said actual thickness is less than said desired thickness, and where the difference between said actual thickness and said desired thickness is greater than a predetermined threshold, adding a thickness to said first layer of one-half said difference;

(p) following step (o), repeatedly executing steps (l) - (o) until said difference falls below said threshold;

(q) following step (p), repeating steps (b) - (j), including

selecting a thickness of said first layer resulting from step (p) as said thickness for said first layer at the repeated step (e), and

excluding thickness of said first layer as an optimization variable at step (j); and

(r) following step (q), repeating steps (k) - (q) for successive layers of said optical filter, wherein each repeated step (k) includes forming each said successive layer on the previous said layer.